Appledore Island, Isle of Shoals, Kittery, Maine
t: 603.964.9011 • shoals.lab@unh.edu • shoalsmarinelaboratory.org

Shoals Marine Laboratory
Sustainable Fisheries (BIOSM 2800/MEFB 702)
10 - 24 June 2019

Course Syllabus and Schedule

Faculty: Dr. Erik Chapman (Erik.Chapman@unh.edu)
Owen C. Nichols (nichols@coastalstudies.org)
Lindsey C. Williams (lcwillia@mit.edu)

Prerequisites: one semester of college-level biology or equivalent; preferably (but not required) familiarity with Excel and PowerPoint

Class enrollment limit: 12

Credit hours: 3 Cornell / 4 UNH

Course Objectives/Goals:
Students will explore the theory and practice of fisheries sustainability through lectures, readings, laboratory exercises, and groundtruthing in the "real world" (in the field) by interacting with local fishermen. This course will focus primarily on species harvested in the Gulf of Maine, with an emphasis on finfish. Topics and activities included in this course are:

- An overview of commercial fisheries in the Gulf of Maine
- Fish collection and dissections
- Fishing gear types and modifications
- Age and growth techniques (length-frequency distributions, otoliths, scales, maturity)
- Quantitative data collection and analysis (species assemblage, diversity, catch-per-unit-effort, forecasting, stock assessment)
- Current, past and future directions in fisheries management strategies (including sector and ecosystem based, community-based and adaptive management)
- Collaborative research and 'conservation' fishing gear
- Environmental changes like ocean acidification and global warming
- Perspectives from different stakeholders in today's New England fisheries
- Hands-on demonstrations with commercial fishermen from different industries
- Sustainable seafood and the marketplace
- Human dimensions of sustainable fishing (cultural and socio-economic issues)
- Creative thinking and collaborative problem-solving skills
- Public communication skills

Course Materials:
Students will be provided pdf copies of all reading materials during the course. Students are expected to participate in group discussions of reading assignments.

Recommended materials: composition book or notebook, clipboard, laptop computer, foul weather gear, water shoes, waterproof boots, binoculars.

Cornell University

University of New Hampshire

Assignments & Grading:
This course utilizes project-based assignments, lectures, demonstrations and hands-on experiences spending time with fishermen on their boats. Grades will be based on student participation and performance in the projects, in-class discussions, quizzes, and exercises.

Course participation and preparedness	20%	
Quizzes (4)		20%
Field projects (3)		30%
Social-ecological Synthesis Case		10%
Final Project (Presentation and Paper)	20%	

Course participation: Success at SML requires a positive attitude and the willingness to accept changes in the schedule with grace. Island living demands respect for your fellow classmates, and residents on Appledore. Students are expected to actively participate in all facets of this course, and to display good citizenship while at Shoals. Students must be on time to all course meetings. They must actively engage by means of asking questions, actively listening, and working with team members when instructed. 5% will be deducted for any missed activity without instructor's permission.

Readings will be assigned throughout the course. Readings will be used to frame group discussions on focus topics that will be facilitated by instructors. The reading list will include selections from:

- *Cod: A biography of a fish that changed the world* by Mark Kurlansky
- *Cross-Grained and Wily Waters: A Guide to the Piscataqua Maritime Region* edited by W. Jeffrey Bolster
- Scientific papers and additional readings
- Readings posted in shared folder - https://unh.app.box.com/folder/50210934230

Guest lectures are an important component of this course. These will provide the perspectives and realities that collectively comprise a "fishery". Students are expected to attend all guest lectures and must actively engage guest speakers. Every student must ask two questions of every speaker that pertains to their course project (and how it relates to the speaker's expertise). Students are free to ask as many questions as they want.

Four quizzes will be given during the course on topics covered by the core faculty and guest lecturers. These quizzes will include a combination of essay questions, lab reports, and fisheries problems.

Demonstration fishing trips also are critical to this course because it is an opportunity for students to appreciate the realities of working as a fisherman. During these trips, students will participate in "collaborative research" projects while participating in (or simulating) demersal trawl net, gill net, lobster, and possibly harpoon fishing operations. In addition, a survey for seabirds and marine mammals will be conducted to demonstrate the importance of other components of the marine ecosystem to fishing practices.

Field/Lab Reports Three fishing trips will be organized as a scientific study with data collected, analyzed, and written up as individual reports. The reports will be produced in small groups and individuals will be asked to contribute some part of the report for each project. These will be due two days after each field trip or lab exercise.

Socio-Environmental Synthesis Case Halfway through the course, students will participate in a two part case study using oyster aquaculture siting as an example of the complex social-environmental systems at play in coastal and ocean issues. Students are expected to fully engage in all discussions, activities, and assignments associated with the case.

Fisheries Project A comprehensive fisheries project will be completed during the course in which a student will identify a current fishery in the Gulf of Maine and will outline the history, current fishing practices, management, relevant biology and ecology, as well as economic, cultural, and social issues related to the fishery. Students will focus on the most recent assessment for their stock. A draft outline will be due part way through the course for peer and faculty feedback. At the end of the course, students will give a 12-minute presentation about their fishery. Students are expected incorporate principles of public communication in their presentations and to ask questions of their peers just as they would a guest speaker.

Expectations and Conduct:
Students are responsible for fully understanding all of the information presented in this syllabus. If there are any questions regarding this information, it is the student's responsibility to bring it to the instructor's attention. In addition, students are responsible for attending all activities associated with this course and completing all assignments. Students are responsible for asking questions anytime they need clarification (remember, there is no such thing as a bad question).

Every student is responsible for their own behavior- specifically in being respectful and collegial to other students and with instructors. Students are responsible for fully understanding and adhering all of the information presented in the SML Appledore Handbook (http://www.sml.cornell.edu/sml_forms.html)

1. *Personal Technology.* Do not use phones, tablets, headphones, or similar devices in the classroom or during course activities. If you take notes with your computer, disable wireless access during lecture.
2. The lab has a modest computer facility in Laighton Library; please treat this shared facility with respect. Printers are available, but please limit printing.
3. *Transmission of Course Materials*. Students are not authorized to replicate, reproduce, copy or transmit lectures and course materials presented, or derivative materials including class notes, for sale or free distribution to others without written consent of the instructors who are the original source of the materials.
4. *Academic Integrity*. Any work submitted must be your own. Uncredited use of another person's words, data or images is considered plagiarism, a serious violation of the Code, whether the material comes from another student, a web site, or a published paper. Students must adhere to Cornell's and UNH's Policy for Academic Honesty/Plagiarism and Discrimination
    A. Cornell: http://cuinfo.cornell.edu/aic.cfm
    B. UNH: www.unh.edu/vpsas/handbook/welcome-university-new-hampshire
5. *Disabilities & ADA Accommodation*. Students with a disability must contact Cornell's (420 CCC building; 607-254-4545) or UNH's Student Disability Services http://www.unh.edu/disabilityservices) four weeks prior to start of class for confidential discussion of needs and for registration to verify eligibility for academic accommodations. No retroactive accommodations can be made.
6. *Mental Health.* Shoals Marine Laboratory cares about you and your well-being. If you experience unusual personal or academic stress during the course or need to talk with someone about a personal problem, seek support from your instructors as soon as possible. In addition, any SML staff is available for consultation 24/7. Find staff in the office in the Hamilton House between 8am – 7pm or knock on the door of Bartell House after hours.

Working Schedule as of 05/29/19:

Details, updates, and corrections to the schedule, assignments and readings will be provided daily: check the whiteboard in Kiggins early and often!

(breakfast 7:30; lunch 12:30 unless otherwise noted; dinner 6pm; Sun. brunch 10am, dinner 5pm)

[1] MONDAY 6/10 Welcome: Life at SML and Course Introduction
Afternoon:
4:00 PM Arrive on Appledore: welcome
Read selection from *Cross-Grained and Wily Waters* (by Bolster, posted in Box).

Evening:
7:00 PM Introductions and course overview (ON/LW)
Syllabus review, discussion of fisheries project and lab expectations, island expectations
View "Saving New England Fisheries" - (http://www.pbs.org/video/2365760136/) discussion.

[2] TUESDAY 6/11 Fisheries Science and Management Overview
Morning:
9:00 AM Lecture/Discussion:
Physical setting of the GOM & Appledore (ON - with Marine Mammal class)
Oceanography of the Gulf of Maine (ON - with Marine Mammal class)
Intro to Ocean and Coastal Policy (LW - with Marine Mammal class)

11:00 AM Lecture / Discussion
Intro to Gulf of Maine fisheries and global fishing trends (ON)
Intro to Common Property Resources/ Hardin&Ostrom (LW)
Intro to fishing industry social characteristics (LW)
Intro to Fisheries Mgmt institutions (LW)

Afternoon:
1:30 PM Fisheries Stock Assessment (ON)
3:00 PM Fish biology and anatomy, Gulf of Maine species ID (ON)
4:30 PM Project/Reading time (prepare questions for Rock Talk)

Evening:
8:00 PM: Rock Talk: Dr. Alix Laferriere (The Nature Conservancy)
Project/Reading time/Notes review

[3] WEDNESDAY 6/12 Gillnet Fishery / Gear Research
Morning:
8:30 AM On The Water: Gillnet demonstration day – on boat (Capt. Tom Lyons)
11:30 AM Fishing Gear Selectivity Intro (ON)

Afternoon:
1:30 PM Gear Research (Chris Glass, Commercial Fisheries Research Foundation)

3:30 PM - quiz expectations and lab report expectations
4:00 - 4:30 PM Food Run (faculty/students help)
5:00PM Lobster biology and management (Heidi Henninger, Atlantic Offshore Lobstermen's Association - AOLA)

Evening:
Start lab 1 - gillnet

- Read: Fisheries of the United States 2017 Intro - https://www.fisheries.noaa.gov/national/fisheries-united-states-2017
- Read: Fisheries Economics Fact Sheet - fisheries.noaa.gov/resource/document/fisheries-economics-united-states-2016-fact-sheet
- Read: Selection from 'Cod' (Ch 2 and 3)
- Optional Reading: Cooper, A.B. 2006. A Guide to Fisheries Stock Assessment *or* NMFS Stock Assessment

Overview - http://www.st.nmfs.noaa.gov/stock-assessment/stock-assessment-101
- Read: Mccarron, P., & Tetreault, H. (2012). Lobster Pot Gear Configurations in the Gulf of Maine. Retrieved from http://www.bycatch.org/sites/default/files/Lobster_Gear_Report_0.pdf
- Read: Grabowski JH, Clesceri EJ, Baukus AJ, Gaudette J, Weber M, Yund PO (2010) Use of Herring Bait to Farm Lobsters in the Gulf of Maine. PLoS ONE 5(4): e10188. https://doi.org/10.1371/journal.pone.0010188

[4] THURSDAY 6/13 Lobster Fishery / Fisheries Ecology
Morning:
0830 On The Water: Lobster fishery demonstration day (Capt. Damon Frampton)
Students will evaluate trap catch efficiency with/without escape vents

Afternoon:
12:30 PM Lecture/Discussion: "There and Back: The Long Road to Recovery for Newfoundland Cod and Lessons for New England" (Graham Sherwood, GMRI)
2:30 PM - Lobster Data Discussion
3:00 PM - Project Group Discussion (putting in ecosystem context)
TBD - Art? TBD - Reading Discussion - Think, Pair, Share (LW)?
Project/Lab time/quiz prep

Evening:
7:00 PM - QUIZ 1 – Practical (GOM Fish), Fisheries Management,Gear Research/Selectivity
Reading/Project Time

[5] FRIDAY 6/14 Marine Mammals and Fisheries
Morning:
10:00 - 2:00PM - Whale Watch w/ Marine Mammal course

Afternoon:
3:00 PM reading discussion? art session? Project time? Documentary screening? Play?
5:00 PM Fisheries/marine mammal interactions (ON/AB)

Evening:
Lab 1 (gillnet) work and due
Project Time
Read: TBD
SKIM: Boundless Excerpt

[6] SATURDAY 6/15 Non-science Communication Approaches in Fisheries
Morning:
8:30 AM - 12:30 PM - Seal Necropsy in P-K (with Marine Mammal class)

TBD - Lecture/Discussion: Science for Fisheries Management, Climate change and Gulf of Maine fisheries, Jon Hare, NEFSC

Afternoon:
1:30 PM - Discussion with Doug Feeney (Fisherman)
2:30 PM - Social-ecological synthesis / Oyster Aquaculture siting case - Part I
Independent project time/reading

TBD - "Rotten: Cod" documentary and/ or *Robert Frost Lobster Video?*
TBD - "Boundless" The Cape Cod Fishing Project - Allison Weller, playwright

Evening:
8:00 PM - TBD (Documentary?, Movie?, Art?)
Oyster case assignment work/reading
Begin Lab 2 - lobster
- Read: Getting to Yes Chapter 1
- Read (skim) - Marine Aquaculture Strategic Plan FY 2016-2020 by NOAA Fisheries. Available: /www.fisheries.noaa.gov/feature-story/noaa-fisheries-marine-aquaculture-strategic-plan

- Read: EDF response to “Cod is Dead” - http://blogs.edf.org/edfish/2018/01/10/rotten-gets-it-wrong-about-new-england-and-catch-shares/

[7] SUNDAY 6/16 Systems Thinking / Fisheries Management Process
Morning:
Aquaculture case prep work
9-10:00 AM Dorm clean up

Afternoon:
11:00 AM - Oyster Aquaculture siting case - Part II (LW)
1:00 PM Common Property Resources/ Hardin&Ostrom /Catch Shares (Part II)
1:30 PM Discuss project draft/outline expectations
2:00 PM Quiz 2 – lobster, fisheries ecology, negotiation
3:00 PM - Project/lab time

Evening:
6:00 PM - Robin Frede, Groundfish analyst, New England Fishery Management Council (NEFMC)
Lab 2 Due - lobster

Add new future of fisheries reading (replace No Silver Bullet)
Read one:
- Olson, J., and P. Pinto da Silva. 2014. Changing boundaries and institutions in environmental governance: perspectives on sector management of the Northeast US groundfish fishery. Maritime Studies 13(1):3. http://www.maritimestudiesjournal.com/content/13/1/3 - OR -
- Brewer, J. F. 2014. Hog Daddy and the Walls of Steel: Catch Shares and Ecosystem Change in the New England Groundfishery. Society & Natural Resources 27(7):724–741. http://dx.doi.org/10.1080/08941920.2014.905811

[8] MONDAY 6/17 Where Do We Go From Here? Science and Stakeholders
Morning:
8:30 AM Project time / informal discussion with Robin Frede
9:30 AM Discussion: Mid-course Reflection (LW/ON)
10:30 AM Project Time / reading / negotiation response
Read:
- Cvitanovic, C., A. J. Hobday, L. van Kerkhoff, S. K. Wilson, K. Dobbs, and N. A. Marshall. 2015. Improving knowledge exchange among scientists and decision-makers to facilitate the adaptive governance of marine resources: A review of knowledge and research needs. Ocean and Coastal Management 112:25–35. 10.1016/j.ocecoaman.2015.05.002

Afternoon:
1:30 PM - Role of social science in fisheries management / Science in a contested setting, stakeholder engagement, disputes, etc. (LW)
3:00 PM - Presentation/Discussion: Community-Based Collaborative Fisheries Research (ON)
4:00 PM - Discussion (readings, collaborative approaches, conflicts over science, etc.)

Evening:
Movie Night – *The Perfect Storm?*
Oyster case writing - Negotiation Reflection and Memo Due
- Read: Zimmerman. 2015. The Piscivore’s Dilemma. Outside Magazine. June 2015: 92-99, 119-123 or https://www.outsideonline.com/1978326/piscivores-dilemma
- Read: Greenberg. 2015. Three Simple Rules for Eating Seafood
- Read: Helvey, M., Pomeroy, C., Pradhan, N. C., Squires, D., & Stohs, S. (2017). Can the United States have its fish and eat it too? Marine Policy, 75(October 2016), 62–67. http://doi.org/10.1016/j.marpol.2016.10.013
- Skim: Monterey Bay Seafood Watch website, NAMA website, New England Fishmongers, NH Community Seafood.

[9] TUESDAY 6/18 Aquaculture, Marketing and the Future of Fishing Communities
Morning:
8:30 AM - New Castle Boat Departure (on docks by 8)

9:00 AM - On The Water: Aquaculture (Erich Berghahn and Aaron Jones, NHSG/UNH), UNH Marine Facility, New Castle
Bag lunches

Afternoon:
1:00 PM - NH Community Seafood - Andrea Tomlinson and Enrica Jossi in New Castle
Tentative - lab walking tour / fort visit / readings discussion (prepare questions for Rock Talk)
5:00 PM - New Castle Boat Return

Evening:
8:00 PM Rock Talk: Dr. Anna Malek Mercer (NMFS Cooperative Research Program)
Project Outline/summary for peer editing due
Read:

- Goethel Handout

[10] WEDNESDAY 6/19Multispecies trawl fishery / Recreational Fishing
Morning
Intro (ON)
0800-130 On The Water: Demersal trawl fishery demonstration day (Capt. David Goethel)
Students will evaluate how changing gear configuration impacts fishing efficiency and selectivity
Bag Lunches on water

Afternoon
2:30 PM Fish filleting (?) and go over lab report expectations
4:00 - 4:30 Food Run (students/faculty help)
Independent project time / reading (remind on water at night)
Read one:

- Golet WJ, Galuardi B, Cooper AB, Lutcavage ME. 2013. Changes in the distribution of Atlantic bluefin tuna (*Thunnus thynnus*) in the Gulf of Maine 1979-2005. PLoS ONE 8(9): e75480. https://doi.org/10.1371/journal.pone.0075480
- -OR-
- Richardson DE, Marancik KE, Guyon JR, Lutcavage ME, Galuardi B, Lam CH, Walsh HJ, Wildes S, Yates DA, and Hare JA. 2016. Discovery of a spawning ground reveals diverse migration strategies in Atlantic bluefin tuna (*Thunnus thynnus*) PNAS 113(12): 3299-3304. http://www.pnas.org/content/113/12/3299.full

Evening:
6:30-10:30PM On The Water: Rec Fishing Trip – Capt. Mark Godfroy – Eastman's Fishing Fleet

[11] THURSDAY 6/20 Apex Predators: Tuna, Sharks, and People Oh My!
Morning:
8:30 AM Federal Agency Roles in Fisheries Management: Deputy Regional Administrator, NMFS Greater Atlantic Regional Fisheries Office (GARFO)
9:30 AM Tuna 101 w/ Walt Golet (Gulf of Maine Research Institute): lecture/dissection/boat tour

Afternoon:
1:00 Local Marketing and Fishing Communities, Local markets, role of the consumer: Tim Rider (New England Fishmongers), Colles Stowell (One Fish Foundation)
3:30 PM Quiz 3 – trawl, fisheries management, writing, aquaculture
TBD - short hagfish lecture (ON)

Evening:
Independent project time
Peer edits due

- Read: Chapter 1 - Northeast Regional Ocean Plan (neoceanplanning.org/wp-content/uploads/2016/10/Northeast-Ocean-Plan-Chapter-1.pdf)
- Read: State of the Ecosystem - Gulf of Maine and Georges Bank (NEFSC)
- Read: Long, R. D., Charles, A., & Stephenson, R. L. (2015). Key principles of marine ecosystem-based management. Marine Policy, 57, 53–60. https://doi.org/10.1016/j.marpol.2015.01.013
- Read: Patrick, W. S., & Link, J. S. (2015). Myths that Continue to Impede Progress in Ecosystem Based

Fisheries Management. Fisheries, 40(4), 155160. https://doi.org/10.1080/03632415.2015.1024308
- Read: Fay, G., DePiper, G., Steinback, S., Gamble, R. J., & Link, J. S. (2019). Economic and Ecosystem Effects of Fishing on the Northeast US Shelf. Frontiers in Marine Science, 6(March), 1–12. https://doi.org/10.3389/fmars.2019.00133
- Optional: Leigh, Katharine L., Jed P. Sparks, and William E. Bemis. "Food Preferences of Atlantic Hagfish, Myxine glutinosa, Assessed by Experimental Baiting of Traps." Copeia 104.3 (2016): 623-627.

[12] FRIDAY 6/21 Sharks, Squid and Slime Eels
Morning:
8:30 -10:30 AM - On-water Hagfishing trip
11:00 AM - Movement, Home Range, and A Shark Nursery in the Caribbean (Bryan Legare, CCS)

Afternoon:
1:30 PM - Science in Public Policy / National Ocean Policy (LW)
2:30 PM - When, Where, and Sometimes Why: Environmental Effects on Squid Distribution (ON)
3:30 PM - Paper reading and discussion, Final project/presentation expectations review (ON/LW)
Lab/Project time

Evening:
TBD - Art Show (tentative)
Lab 3 Due - trawl
Work on quiz prep/presentations/final project

[13] SATURDAY 6/22
Morning:
9:00 AM - Practice presentations
Work on quiz prep/presentations/final project
AM - optional otolith lab

Afternoon:
Independent project time

Evening:
7:30 PM - Final Project Presentations

[14] SUNDAY 6/23 Information Integration: Class Review and Discussion
Morning:
9:00 -10:00 AM Dorm clean up

Afternoon:
11:00 AM QUIZ 4 – summary/synthesis and reflection questions
12:00 PM - Career Discussions / Course Review / Evaluations
Project work time

4:59 PM - Final Project Paper Due

Evening:
6:00 PM Marine Mammal Symposium
8:00 PM Star Island Visit

[15] MONDAY 6/24 Course Wrap Up
Morning:
8:30 AM - Final Check In (luggage out on porches)
9:45 AM Depart Island (in town around 11:00 AM)